RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations of Alaska.

Project No.: F-9-11

Study No.: G-I Study Title: INVENTORY AND CATALOGING

Job No.: G-I-F Job Title: Inventory and Cataloging of Sport Fish and Sport Fish Waters of the Copper River, Prince William Sound, and the Upper Susitna River Drainages.

Period Covered: July 1, 1978 to June 30, 1979.

ABSTRACT

Twenty-one managed lakes were test netted to determine survival and condition of experimentally stocked fish and the status of native fish stocks.

A creel census of sport fishermen was conducted for the fourth consecutive year on the Gulkana River. There was a 30 percent increase in the number of chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), caught. This creel census revealed that 5,065 anglers fished 27,406 hours and caught 492 chinook salmon and 392 sockeye salmon, *O. nerka* (Walbaum). During salmon escapement counts conducted after the sport fishery terminated, a total of 1,136 chinook salmon were enumerated in the Gulkana River. This number is slightly higher than the 6-year average of 1,024.

Length data were taken from 190 sport caught Gulkana River Arctic grayling, *Thymallus arcticus* (Pallas). These fish ranged in fork length from 197 to 425 millimeter and averaged 294 millimeter. Measurements taken of 100 grayling captured in 1968 demonstrated a length range of 177-425 millimeters, and an average length of 290 millimeters.

Salmon escapement surveys were conducted in 1978 on streams tributary to Valdez Bay; 77 pink salmon, *O. gorbuscha* (Walbaum), and 6,734 coho salmon, *O. kisutch* (Walbaum), were counted.

A creel census of sport fishermen was conducted in Valdez Bay during 1978. Seven thousand four hundred sixty-two anglers fished 44,566 hours to catch 7,492 pink salmon, 1,967 coho salmon and 1,239 chum salmon, *O. keta* (Walbaum). Experiments were conducted at Valdez to determine the feasibility of rearing coho salmon smolts in the sewer lagoon system. High water temperatures, chlorination treatment and interrupted flows of aeriated water appear to severely limit any potential for fish rearing.

Studies of the Robe Lake system were continued in 1978. From these studies it is apparent there is no practical means of improving smolt rearing capabilities in the system.

BACKGROUND

The Copper River Basin and Upper Susitna River drainage areas are typical of many within the state in that recreational angling opportunity is provided by a number of anadromous species and by indigenous and stocked lake and stream dwelling fishes.

The stream dwelling species most often taken by sport anglers are Arctic grayling, chinook and sockeye salmon.

The principal lake dwelling species caught by recreational anglers in the Glennallen area are the indigenous species, burbot, lake trout, and Arctic grayling; and the introduced species, coho salmon and rainbow trout.

The majority of angling pressure is on waters adjacent to the highway system. This area, including the Copper Basin, Cordova and Valdez, has over 650 miles of the Alaska Highway System. A map of the study area is presented in Figure 1.

The Cordova area is primarily commercial fishing oriented. Access to this area is only by boat or aircraft. Sport fishing effort in salt water is light and primarily for coho salmon, chinook salmon, and halibut. Fresh water angling is directed toward coho salmon, cutthroat trout, Dolly Varden, and stocked grayling. A significant increase in sport fishing effort is not anticipated until access to and within the area improves.

Most of the recreational angling opportunities in the Valdez area are provided by anadromous species, including pink salmon, chum salmon, coho salmon, and bottom fish. All freshwater drainages into Valdez Arm are closed to salmon fishing, but Dolly Varden are taken in fair numbers.

Since the completion of the Trans-Alaska pipeline, there has been a substantial decrease in the human population. However, the number of people permanently retained for maintenance of the pipeline brings the population above pre-pipeline levels. The fish stocks are generally in good condition, so there appears to be no need for more restrictive angling regulations at the present time.

Activities reported in the following text are directed toward the research and management needs of these species and toward the attainment of desirable levels of angler utilization. The species of fish discussed in this report are listed in Table 1.

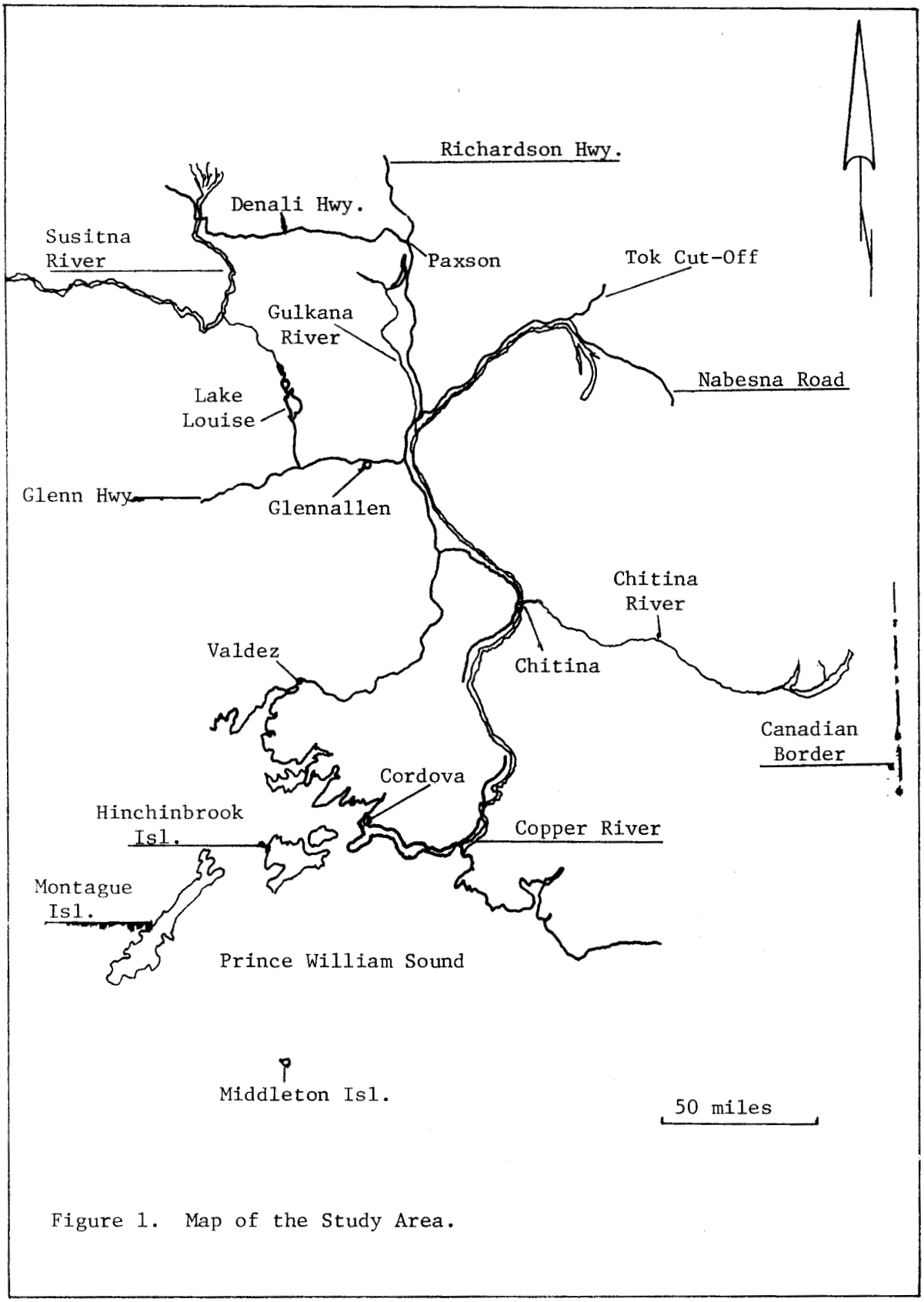

Figure 1. Map of the Study Area.

Table 1. List of Fish Species Discussed in This Report

Common Name	Scientific Name and Author	Abbreviation
Pink salmon	*Oncorhynchus gorbuscha* (Walbaum)	PS
Chinook salmon	*Oncorhynchus tshawytscha* (Walbaum)	KS
Chum salmon	*Oncorhynchus keta* (Walbaum)	CS
Coho salmon	*Oncorhynchus kisutch* (Walbaum)	SS
Sockeye salmon	*Oncorhynchus nerka* (Walbaum)	RS
Dolly Varden	*Salvelinus malma* (Walbaum)	DV
Lake trout	*Salvelinus namaycush* (Walbaum)	LT
Rainbow trout	*Salmo gairdneri* Richardson	RT
Steelhead	*Salmo gairdneri* Richardson	SH
Cutthroat trout	*Salmo clarki* Richardson	CT
Arctic grayling	*Thymallus arcticus* (Pallas)	GR
Threespine stickleback	*Gasterosteus aculeatus* Linnaeus	TST
Burbot	*Lota lota* (Linnaeus)	BB
Halibut	*Hyppoglossus stenolepis* Schmidt	H
Sucker	*Catostomus catostomus* (Forster)	S

RECOMMENDATIONS

1. The study of anadromous fish stocks in the Upper Copper River drainage and Prince William Sound should be continued to determine timing and magnitude of runs.

2. Monitoring of seismic activities, road and bridge construction, pipeline maintenance, and other land uses should be continued to afford maximum protection to the fishery resource and habitat.

3. Continued evaluation should be made of experimental fish stocking to determine the species of fish best suited for individual lakes and to compare the survival and growth of various races of rainbow trout and coho salmon.

4. Cataloging and inventory surveys should be continued on a limited basis as required to increase our knowledge of the fisheries resources in the area and provide more fishing opportunities for the angler.

5. Investigations of grayling in the Gulkana River should be continued to determine age-length composition of sport caught fish.

6. Investigations of waters in the Valdez area should continue as required to determine the feasibility of proposed rehabilitation and enhancement programs of salmon stocks.

7. Creel census programs of primary fisheries such as the Gulkana River and Valdez Bay should be continued to determine trends in harvest and effort.

OBJECTIVES

1. To determine the magnitude of various fish stocks and develop plans for their enhancement.

2. To determine stocking measures, formulate recommendations for the management of area waters, and direct the course of future studies.

3. To determine the environmental characteristics of the existing and potential recreational fishing waters of the job area, and where practical, obtain estimates of the sport fish harvest and angler participation rates.

4. To determine the effects of proposed construction programs on fisheries and fisheries environments, and assist in determining the current status of public access, and access needs to the recreational fishing waters within the job area.

TECHNIQUES USED

Standard techniques described by Williams (1971) were used in lake and stream surveys and for collection of fish samples. Each test netting was conducted for a minimum of 16 hours, including an overnight period. Salmon enumerations were made from aircraft and on foot. All measurements of fish lengths were from snout to fork of tail.

The Gulkana River was divided into three sections for purposes of creel census, based on accessibility. These sections were (1) lower, from the mouth upstream for a distance of two miles; (2) middle, in the vicinity of the Richardson Highway bridge; and (3) upper, from the mouth of Sourdough Creek upstream to the West Fork of the Gulkana River.

During the creel census on the Gulkana River the fishing day was determined to be between the hours of 8 a.m. and midnight, and was further divided into four separate 4-hour periods. Weekends and holidays were each censused during two randomly chosen 4-hour periods. Two randomly chosen weekdays per week were each censused during one randomly selected 4-hour period. This creel census schedule was applied to all three sections.

During the creel census conducted at Valdez the fishing day was determined to be from 7 a.m. to 10 p.m. This fishing period was divided into two 7 1/2-hour periods. Period A was from 7 a.m. to 2:30 p.m. and Period B was from 2:30 p.m. to 10 p.m. During weekdays censusing was conducted during six randomly selected periods. On weekends and holidays censusing was conducted during the entire fishing day.

During Robe Lake investigations minnow traps were used to collect juvenile salmon. Dissolved oxygen concentrations were determined using a Hach kit with powder pillows.

FINDINGS

Population Sampling, Managed Lakes

Test netting was conducted on 21 managed lakes in the Copper River and Prince William Sound drainages during 1978 and the results are shown in Table 2.

South Jans Lake was test netted in 1978, and at that time 154 coho salmon were taken at a rate of 4.28 per net hour. Test netting carried out in 1977 resulted in a catch of only two salmon for a catch rate of 0.09 per net hour. The 1977 test netting was done in mid-June and in 1978 netting was carried out in mid-August, thus direct comparisons are not applicable. The longer daylight hours in June may have also been a factor influencing the low catch because of net avoidance.

Peanut Lake was stocked with coho salmon in 1973 and 1977. Test netting in 1978 took only four salmon for a catch per net hour of 0.19. Test fishing with rod and reel was conducted at the same time and 19 coho salmon were

Table 2. Gill Net Summary, Previously Surveyed Lakes, 1978.

Name	Location	Number of Fish	Species	Length Range (mm)	Mean Length (mm)	Frequency**	Percent Composition
Buffalo	S25E 1/4 T3N R7W	16	SS	205-240	220	.73	80
		4	RB	305-405	340	.18	20
Crater	S29 T4N R6W	2	RB	200-220	210	.09	100
Forty Foot	S16 T4N R7W	5	GR	140-230	201	.23	100
North Jans	S17 T6N R6W	179	RB	92-331	223	1.88	100
South Jans	S21 T6N R6W	154	SS	180-270	223	4.28	100
Moose	S13,14 T4N R5W	12	GR			.14	63
		6	SK			.07	32
		1	BB			.01	5
Peanut	S16 T4N R7W	4	SS	120-145	132	.19	100
Peanut	Rod & reel, 2.5 angler hours	19	SS			7.60	100
Sculpin	S16 T4S R7E	12	RB	265-520	338	.32	100
Spruce	S4 T5N R7W	4	SK	413-455	434	.18	57
		2	GR	212-218	215	.09	29
		1	BB	468	468	.04	14
Strelna	S7 T4S R7E	44	SS	169-312	232	2.05	98
		1	RB	477	477	.05	2
Small Lake (Tok Hwy.)	S33 T5E R11N	48	SK	250-485	425	1.1	100
Robe	S17 T9N R5W	44	SS	85-115	99	.56	67
		16	DV	105-460	309	.21	25
		5	RS	510-590	562	.06	8
4-1/2 Mile Pit	S20 T9N R5W	19	DV	110-500	322	.36	100
Tex Smith	S27 T4N R6W	4	SS	225-300	264	.44	100
Three Mile	S35 T3S R5E	99	GR	109-240	173	3.54	94
		6	RB	220-290	242	.21	6
Tolsona	S24 T4N R5W	47	GR	101-368	245	2.47	77
		14	SK			.73	23
Two Mile	S2 T4S R5E	0				.73	23
Van	S21 T4S R7E	9	SS	200-450	329	.20	70
		3	RB	235-480	392	.07	23
		1	DV	260	260	.02	7
Old Road	S14 T4N R7W	0					
Old Road	Rod & reel, 1.5 angler hours	9	SS	126-185	145	6.0	100
Round	S14 T4N R7W	1	RB	285	285	.67	100
Tiny	S16 T4N R7W Rod & reel, 1.5 angler hours	10	RB	149-190	170	6.67	100

* DV = Dolly Varden
SS = Coho salmon
GR = Grayling
RB = Rainbow trout
SK = Sucker

** Frequency is number of fish per net hour.

taken at a rate of 7.60 fish per hour. This lake was also netted during mid-summer when long daylight hours could have increased net avoidance.

North Jans Lake received an experimental planting of 8,000 Swanson River rainbow trout and 4,000 Ennis-Ship Creek rainbow trout in October, 1977, for the purpose of determining which strain exhibited the best survival and growth. Both strains of trout were stocked as fingerlings. The Ennis-Ship Creek trout were the larger of the two at 103/lb., while the Swanson River trout were 131/lb. Total stocking density of the lake was 207 fish/acre with the densities for Swanson River and Ennis-Ship Creek rainbow at 138 and 60 fish/acre, respectively. This density is considered light; however, no more rainbow trout were available for the experiment. Both strains of trout were marked; the Swanson River trout had a left ventral fin removed and the Ennis-Ship Creek rainbow trout had a right ventral fin clip. At the time of stocking the lake was considered barren of other fish, since only two adult coho salmon were taken in 123 hours of test netting.

Survival and growth data were collected from fish taken by variable mesh gill test nets in September of 1978. Growth information showed little difference between species; the Ennis-Ship Creek rainbow and the Swanson River stock had mean fork lengths of 245 mm and 222 mm, respectively. Gill net catch data shows 197 fish were caught in 95 hours of effort. Swanson River rainbow contributed 162 for a net frequency of 1.72 fish per net hour, while nine Ennis-Ship Creek fish taken had a net frequency of .09 fish per net hour and seven rainbow trout could not be identified as to origin because of fin regeneration. This pattern had been previously reported by Watsjold (1973, 1975) when Age 1+ Ennis trout showed poor survival rates in Matanuska Valley waters. Test netting in 1978 captured .02% of the Swanson River trout originally stocked, compared to .002% of the Ennis-Ship Creek trout originally planted in North Jans Lake.

Gulkana River Creel Census

A creel census of recreational fishermen was conducted for the fourth consecutive year on the Gulkana River (Figure 2). This census was conducted from June 12 through August 13. The estimated effort and harvest is presented and compared to 1976 and 1977 data in Table 3. There was a 30% increase in the number of anglers from 1977 to 1978 and a 48% increase in the number of chinook salmon caught. The increase in the chinook catch was in the lower section where 112 chinook salmon were taken in 1978, compared to four in 1977. Better water conditions in 1978 was the prime factor affecting the catch. The number of anglers in the lower section increased by only 21% over 1977.

The catch of salmon per hour and per angler was down from 1977 because the catch of sockeye salmon was reduced 61%. The escapement of sockeye salmon in 1978 was considerably below normal.

Most of the anglers fishing the upper section of the Gulkana River utilized boats (Table 4). In 1978, 41% of the anglers floated the river from Paxson Lake to Sourdough, a distance of 50 stream miles. Forty-two percent of the

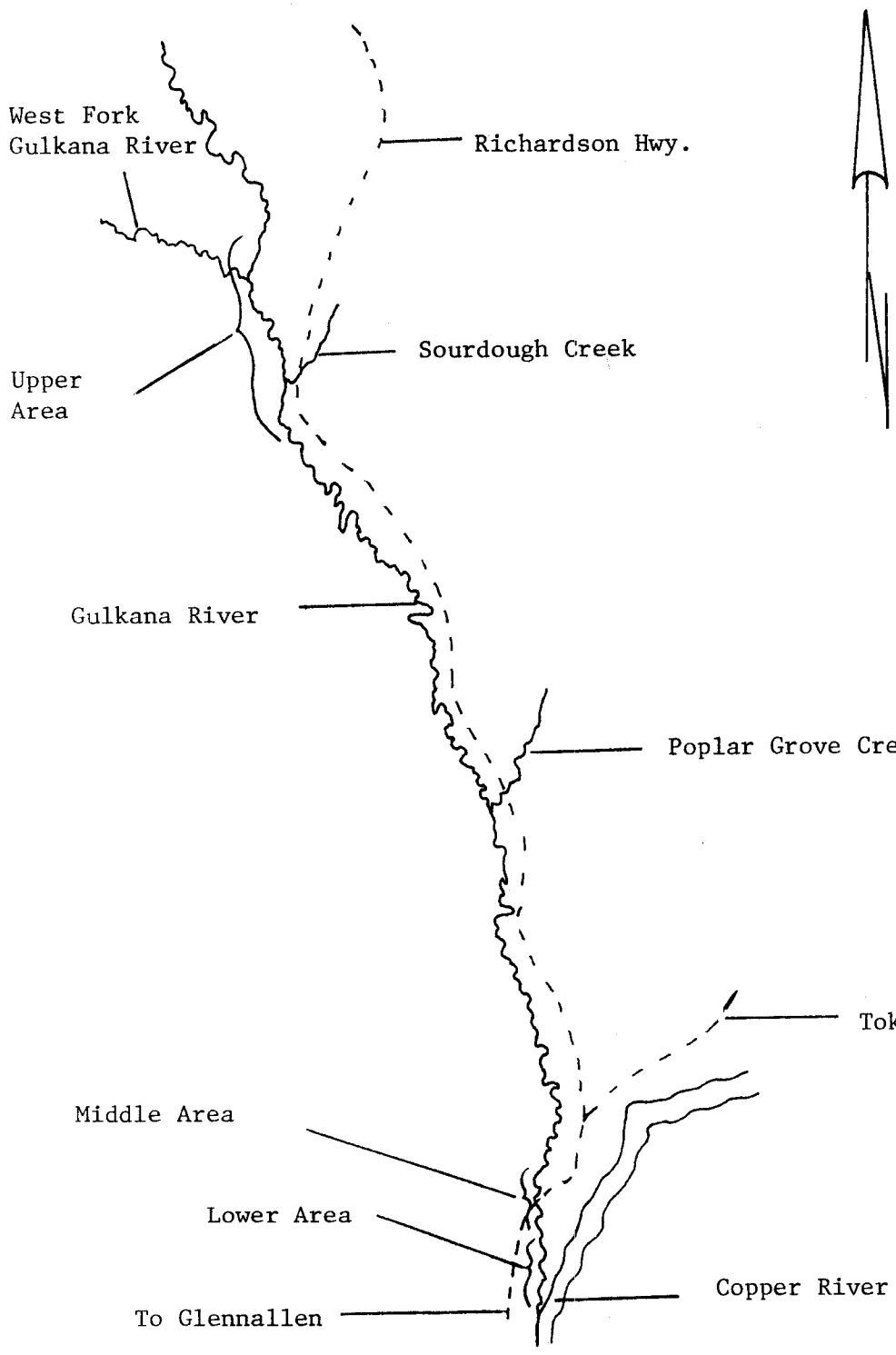

Figure 2. Gulkana River Creel Census Areas.

Table 3. Gulkana River Sport Harvest and Effort Estimates, 1976-1978.

	Lower Section			Middle Section			Upper Section			All Sections		
	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978
No. of anglers	872	780	942	982	1,550	1,613	867	1,576	2,510	2,721	3,906	5,065
No. of hours	4,670	3,599	5,326	3,933	4,853	5,362	3,741	9,283	16,718	12,344	17,735	27,406
Hours per angler	5.36	4.61	5.65	4.01	3.13	3.32	4.31	5.89	6.66	4.54	4.54	5.41
Catch												
Chinook	62	4	112	70	92	64	164	236	253	296	332	429
Sockeye	252	224	132	138	236	26	317	538	243	707	998	401
Total salmon	314	228	244	208	328	90	481	774	496	1,003	1,330	830
Rainbow trout	10	0	15	0	10	38	60	94	228	70	104	281
Catch per angler												
Chinook	0.071	0.005	0.119	0.071	0.059	0.040	0.189	0.150	0.101	0.109	0.085	0.085
Sockeye	0.289	0.287	0.140	0.141	0.152	0.016	0.366	0.341	0.097	0.260	0.256	0.079
Total salmon	0.360	0.292	0.259	0.212	0.211	0.056	0.555	0.491	0.198	0.369	0.341	0.164
Catch per angler hour												
Chinook	0.013	0.001	0.021	0.018	0.019	0.012	0.044	0.025	0.015	0.024	0.019	0.016
Sockeye	0.054	0.062	0.025	0.035	0.049	0.004	0.085	0.058	0.015	0.057	0.056	0.015
Total salmon	0.067	0.063	0.046	0.053	0.068	0.017	0.129	0.083	0.030	0.081	0.075	0.031

Table 4. 1978 Upper Gulkana River Harvest and Effort Estimates by Angler-Types.

	Floaters	Power Boaters	Other Anglers	Total
Angler-days	1,036	1,053	421	2,510
Angler-hours	4,787	9,230	2,701	16,718
Hours per angler-day	4.62	8.77	6.42	6.66
Harvest				
King salmon	53	198	2	253
Red salmon	101	87	55	243
Grayling	1,257	715	86	2,058
Rainbow trout	167	32	29	228
Harvest per angler-day				
King salmon	0.051	0.188	0.005	0.101
Red salmon	0.097	0.082	0.131	0.097
Grayling	1.213	0.679	0.204	0.820
Rainbow trout	0.161	0.030	0.068	0.091
Harvest per angler-hour				
King salmon	0.011	0.021	0.001	0.015
Red salmon	0.021	0.009	0.020	0.015
Grayling	0.263	0.077	0.032	0.123
Rainbow trout	0.035	0.003	0.011	0.014

anglers used power boats, originating at Sourdough, and traveled upstream to the West Fork area to fish, and the remainder of the anglers fished from the bank. As can be seen in Table 4, over half (57%) of the salmon were harvested by anglers using power boats, 31% by float fishermen, and 12% by bank anglers. The majority of the grayling (61%) were taken by float fishermen and power boaters. Float fishermen and bank fishermen took 35% and 4%, respectively. The prime grayling fishery is upstream from the mouth of the West Fork, which is the upstream limit of most power boats.

A review of the residency of anglers using the Gulkana River, Table 5, shows only slight changes since 1975. There has been a small increase in the number of Alaskan communities represented and a general decrease in the percentage of anglers from the Anchorage area. Chinook salmon fisheries on the Kenai Peninsula have possibly attracted more anglers to that area.

The sport catch of rainbow trout from the Gulkana River increased 170% in 1978 over 1977. The majority of this increase was in fish caught in the upper section by float anglers (Table 3).

Chinook Salmon Escapement

Chinook salmon aerial escapement surveys were conducted on selected streams in the upper Copper River drainage again in 1978. Counts made from 1973 through 1978 are shown in Table 6. The Gulkana River is the major chinook salmon stream in the Copper River drainage. The average annual count from 1973 through 1978 is 1,024 salmon, and the 1978 enumeration of 1,136 shows that the stocks are in a stable condition.

Gulkana River Chinook Salmon Lengths and Age Structure

In 1978 fork lengths and scale samples were taken from 54 chinook salmon caught by sport fishermen. Length range and average length are compared to data collected since 1972 and are presented in Table 7. During these seven years the average length of chinook salmon has varied from 988 to 1,089 which is insignificant. The smallest chinook salmon measured annually has varied from 610 to 770 mm and the largest from 1,160 to 1,255 mm.

The scales collected were read and the data are presented in Figure 3 and compared to age information secured in 1975 and 1976. There is considerable fluctuation in the various age groups from year to year; however, age group 1.3 has been consistently dominant. Data from 1977 was not used because only a few scale samples were collected from chinook salmon.

Gulkana River Grayling

During July of 1978 the Gulkana River was floated twice from Paxson Lake to Sourdough to collect length frequency data on Arctic grayling. These fish were collected by rod and reel. Figure 4 shows the fork length frequencies of the 190 grayling taken. Table 8 compares the fork length information taken in 1978 by angling with data collected from 100 grayling in 1968. From this information it appears that there has been no change in length

Table 5. Residency of Anglers Fishing the Gulkana River in 1975-1978.

	1975	1976	1977	1978
No. of Alaska communities represented	11	15	17	24
No. of other states represented	19	20	28	27
No. of other countries represented	2	2	5	3
Percent of anglers from Alaska	91	91	87	89
Percent of anglers from Anchorage	55	37	33	24
Percent of anglers from Fairbanks	21	32	20	30

Table 6. Chinook Salmon Aerial Surveys, Upper Copper River Tributaries, 1973-1978. *

Stream	1973	1974	1975**	1976	1977	1978
Gulkana River	1,060	1,293	740	994	924	1,136
East Fork Chistochina River	476	138	71	289	132	137
Mendeltna Creek	15	13	NC	35	73	52
Kaina Creek	172	55	NC	37	91	125
Grayling Creek	47	0	NC	17	NC	92

* The figures are actual counts and not estimates. These data are considered as minimum escapement figures.

** Counting conditions in 1975 were generally poor due to high, muddy water during most of the season.

NC No counts made.

Table 7. Lengths of Gulkana River Chinook Salmon, 1972-1978.

Year	Number of Fish	Length Range (mm)	Average Length (mm)
1972	33	770-1,160	1,026
1973	38	665-1,210	1,025
1974	37	650-1,222	1,089
1975	93	724-1,219	1,001
1976	50	673-1,240	1,027
1977	40	667-1,200	988
1978	54	610-1,255	1,006

Table 8. Length Data from Gulkana River Arctic Grayling, 1968-1978.

Year	Number of Fish	Length Range (mm)	Average Length (mm)
1968	100	177-425	290
1978	190	177-425	294

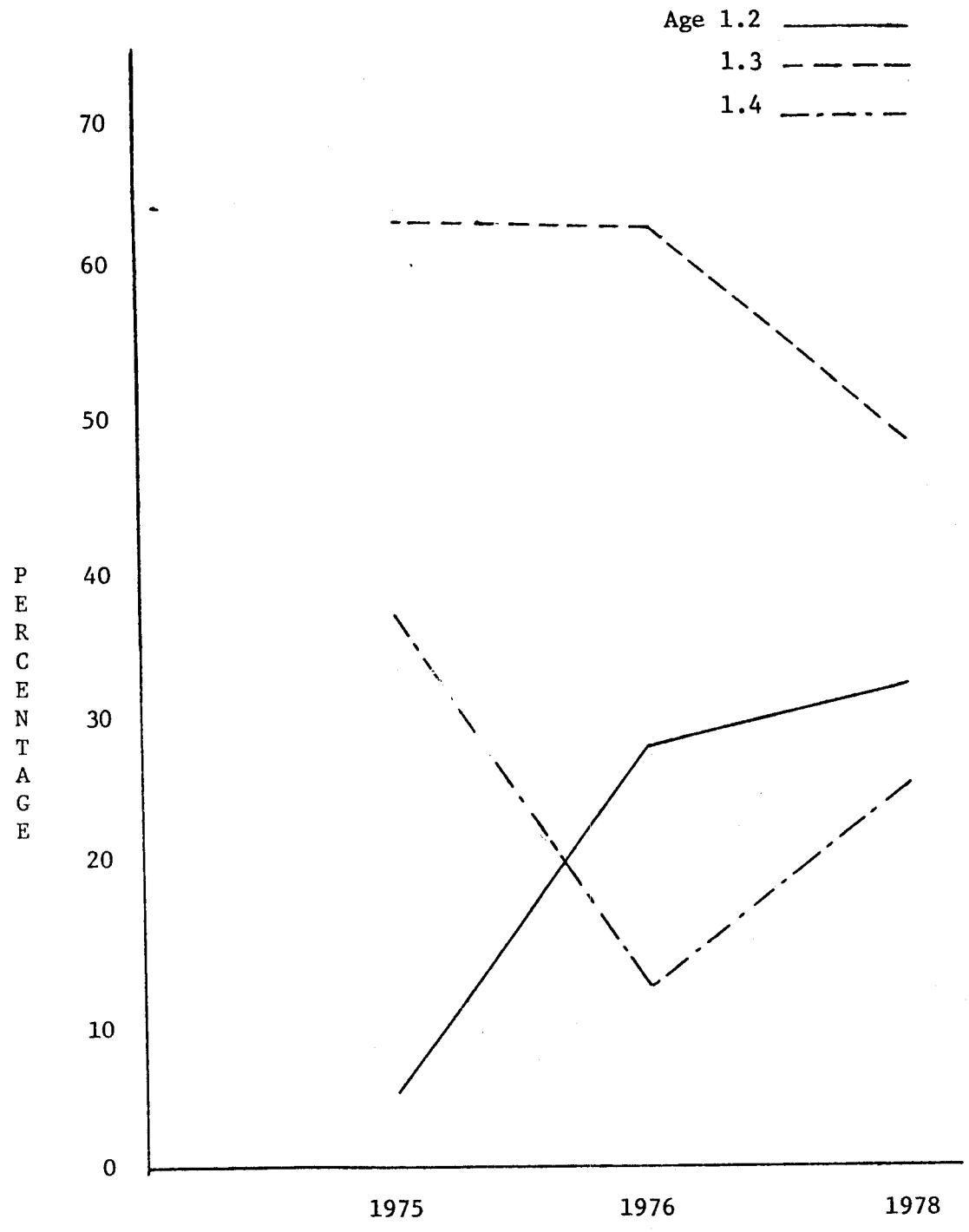

Figure 3. Length frequency of Gulkana River chinook salmon, 1975, 1976, 1978.

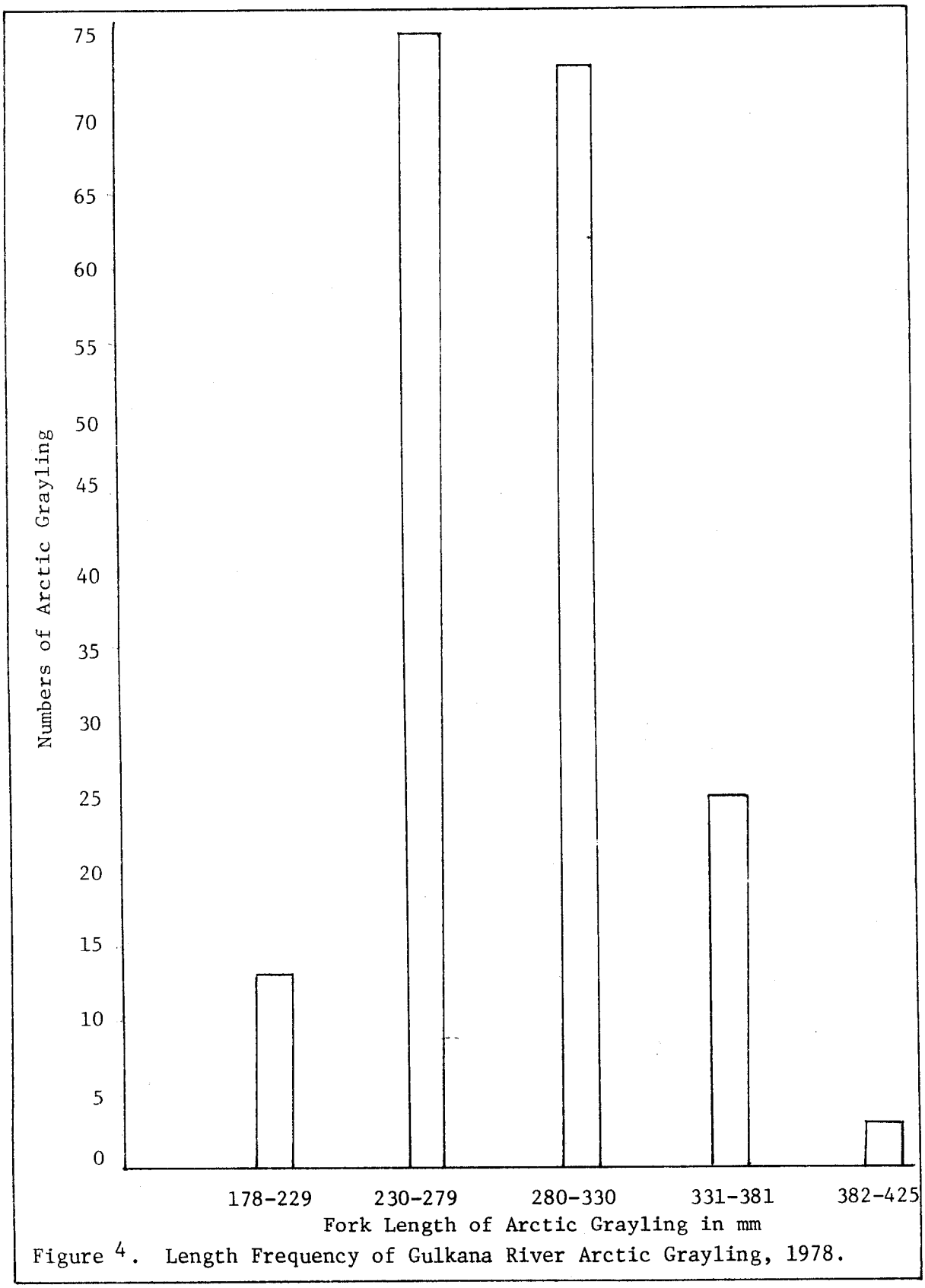

Figure 4. Length Frequency of Gulkana River Arctic Grayling, 1978.

frequencies during the past 10 years. The grayling collected in 1968 and 1978 were caught from Paxson Lake downstream to the falls.

Valdez Bay Creel Census

During 1978 a creel census of sport fishermen utilizing Valdez Bay was conducted. Completed anglers were contacted at the dock ramps and the boat launching site. Harvest and effort estimates are presented and compared to 1974 data in Table 9. The 1974 creel census was conducted from July 1 through August 31, while the 1978 census was from June 17 through August 31. Although the 1978 census was 14 days longer than in 1974, 23% fewer anglers were recorded.

Anglers caught 1,350 more pink salmon than in 1974. However, conversely, they caught 4,783 fewer coho salmon in 1978 than in 1974, even though the escapement was the highest in five years. Some anglers felt that the coho salmon did not enter the sport fishing area of Valdez Bay in 1978 until most of the sport fishing had ceased.

The Commercial Fish Division records show tht only 59 coho salmon were taken by commercial fishermen in the area just seaward of that portion of Valdez Bay utilized exclusively by sport fishermen; therefore, it is doubtful the commercial catch would have been an influence on the low catch of coho salmon by sport fishermen.

Table 10 shows the residency of sport fishermen utilizing Valdez Bay in 1978. From this table it can be seen that there was a greater percentage of anglers from Valdez in the fishery than in 1971 and 1974. This may be due to an increase in the population of Valdez since 1971. The fishery attracted significantly fewer numbers of out-of-town anglers in 1978.

Port Valdez Stream Surveys

Adult salmon counts in the Valdez area were again conducted in 1978 (Table 11). Figure 5 shows the location of the streams which were surveyed. Since this was an even year, a low run of pink salmon was expected. The data presented in Table 11 reflects this pattern. The coho salmon escapement was the highest recorded during the 6-year period.

Valdez Salmon Enhancement Studies

The primary limiting factor on coho salmon production in the Valdez area is the lack of natural waters that will overwinter smolt.

In 1978 studies were conducted to determine the feasibility of rearing smolt in the Valdez sewer lagoon system.

The sewer lagoon system is comprised of three cells (Figure 6). Coho salmon smolts were trapped in the Robe River in June and transplanted to live cars in cells 2 and 3. Cell No. 1 was not used because it contains raw sewage. City of Valdez personnel monitor the dissolved oxygen concentrations at the

Table 9. A Comparison of Valdez Bay Sport Fish Effort and Harvest Estimates, 1974 and 1978.

	1974	1975
Angler days	9,708	7,462
Angler hours	46,905	44,566
Hours per angler	4.83	5.97
Total pink salmon	6,142	7,492
Total coho salmon	6,750	1,967
Total chum salmon	463	1,239
Pink salmon per hour	0.131	0.168
Coho salmon per hour	0.144	0.044
Chum salmon per hour	0.010	0.028
All salmon per hour	0.285	0.240

Table 10. A Comparison of the Residency of Sport Fishermen, Valdez Bay, 1971, 1974 and 1978.

Residency	Percent of Fishermen 1971	1974	1978
Valdez	32	37	53
Fairbanks		23	25
Anchorage		12	4
Remainder of Alaska	58	17	9
Non resident	10	11	9

Table 11. Port of Valdez Salmon Counts, 1973-1978.

Stream	#139 Sewage Lagoon	#137 Lowe River System	#137 Robe Lake System	#141 Loop Road I	#142 Loop Road II	#143 Siwash	#145 City Limits	#147 Mineral Creek System
Pink Salmon								
1973		6,549	15,000	7,000		26,770	1,700	2,235
1974		N/C	N/C	262		8	98	217
1975		15,387	2,461	5,537		33,113	1,262	947
1976		1	0	18		5	5	8
1977	1,418	1,441	330	18,718	4,101	22,120	2,714	179
1978	0	0	2	66	0	0	10	0
Chum Salmon								
1973		1,063	125	N/C		232	1,812	7,111
1974		N/C	N/C	0		16	483	1,454
1975		N/C	N/C	N/C		N/C	N/C	N/C
1976		270	0	6		2	1,080	564
1977	0	0	0	0	0	0	0	0
1978	0	1	0	0	0	0	111	68
Coho Salmon								
1973		N/C	4,000	N/R		6	N/R	20
1974		N/C	1,662	N/R		0	N/R	0
1975		1,506	1,533	N/R		0	N/R	16
1976	0	1,310	1,049	0		0	2	66
1977	0	1,363	1,522	N/R	0	N/R	N/R	1
1978	0	1,643	5,091	0	0	0	0	0

N/C = No count taken.
N/R = No run.

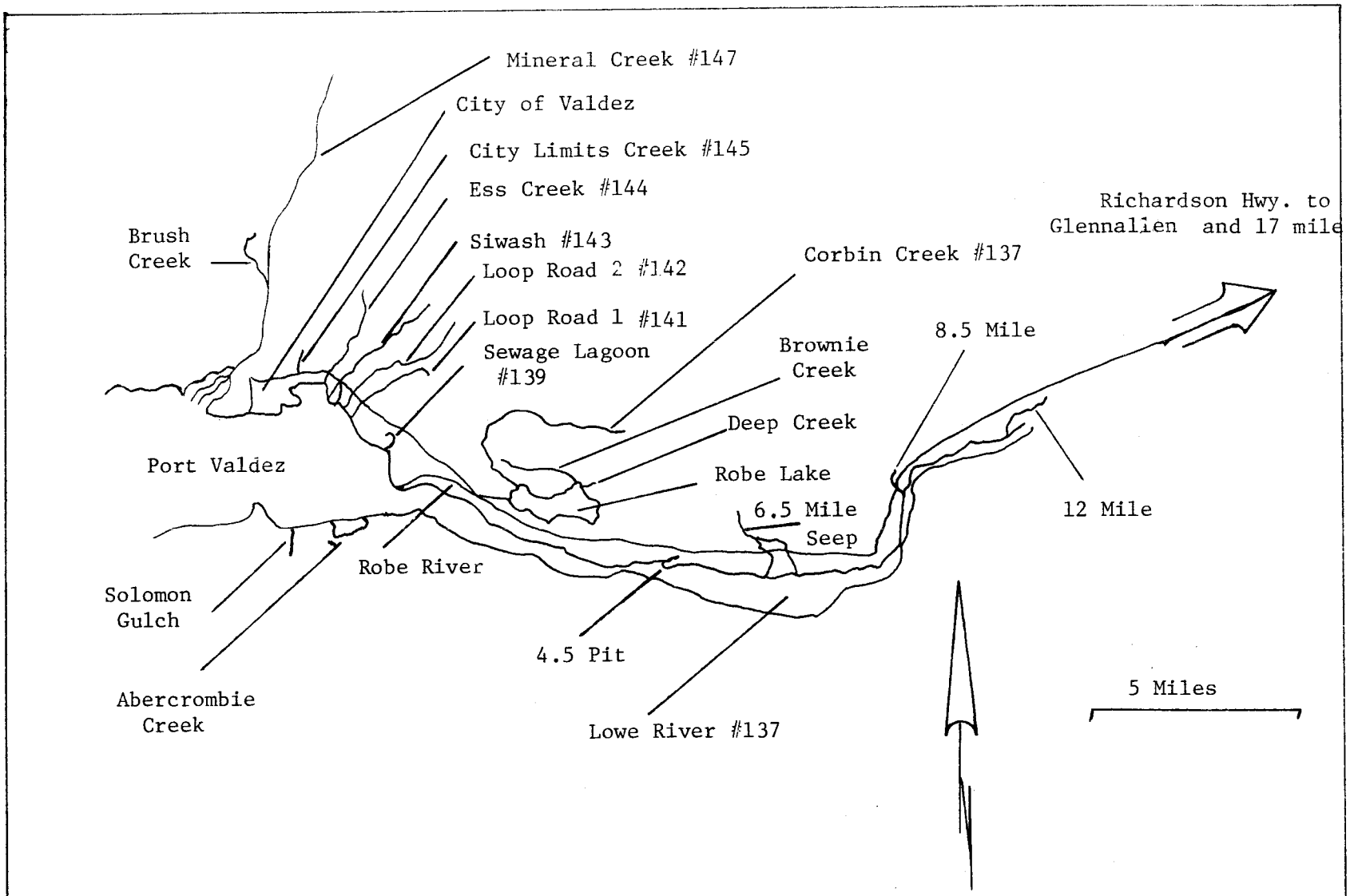

Figure 5. Salmon Spawning Streams in Upper Valdez Bay.

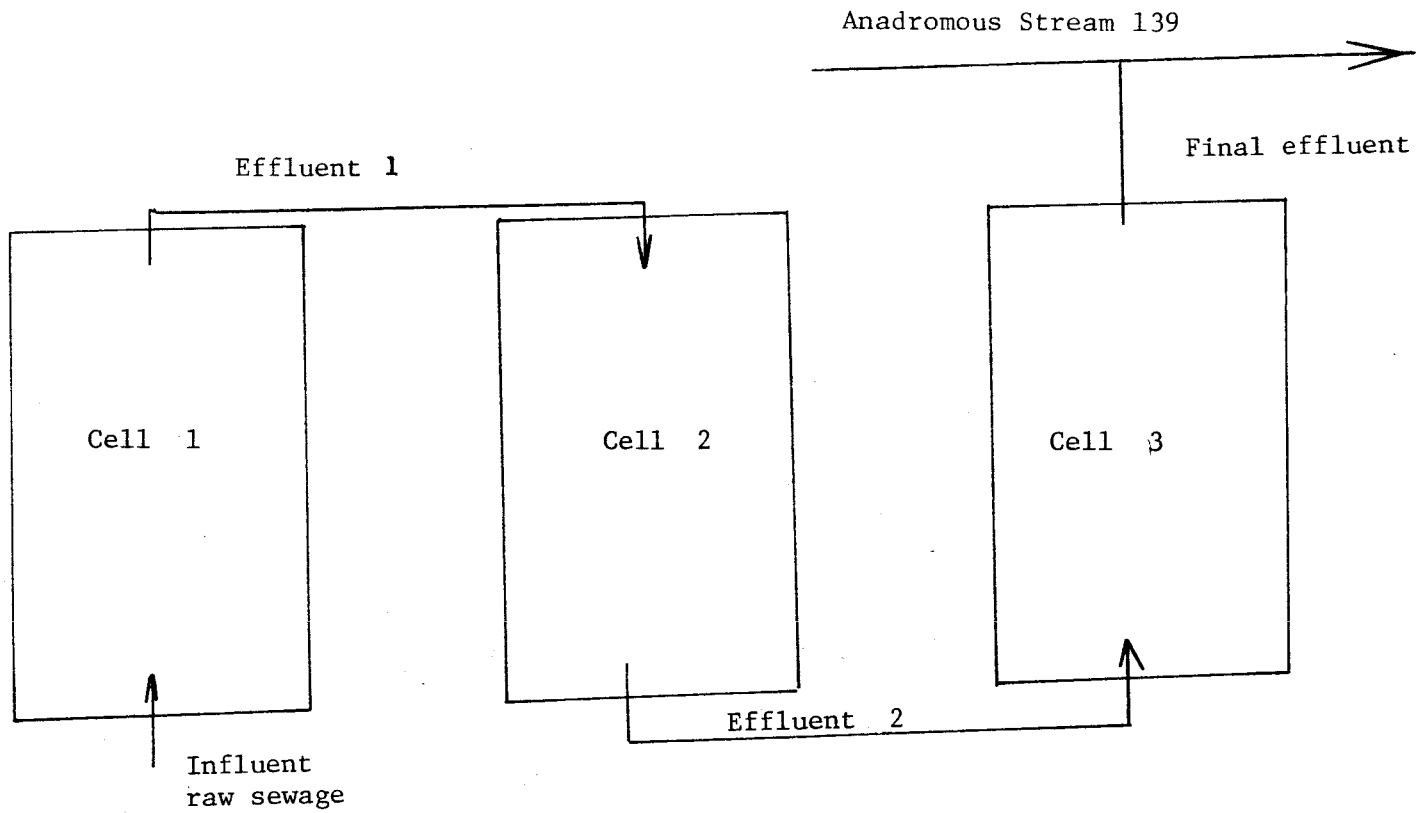

Figure 6. Valdez Sewage Lagoon.

outlet of cell No. 3 daily. Continuous flows of aeriated water flow through the system which has a high population of daphnia sp., a good food for smolt. Use of cell No. 3 was discontinued in July because of a chlorination treatment added between cells 2 and 3. A standard hach field kit was used to determine the 7 ppm dissolved oxygen concentrations found in cell No. 2. Conditions remained favorable in cell No. 2 through June; however, water temperatures began to rise in July. In August an electrical power outage caused the aeriators to shut down. High water temperatures (up to 18^{o}c) and low dissolved oxygen concentrations were lethal for the coho smolt.

It is apparent from this study that very little potential exists for using the sewer lagoon system as a coho salmon smolt rearing site. High summer water temperatures, the undependability of the aeriation system and daily clorination treatments are the primary factors which would be detrimental to a smolt rearing program.

Robe Lake Investigations

Robe Lake, located near Valdez, is an euthropic lake with a surface area of 600 acres and a maximum depth of 15 feet. The average depth is 8 feet and the surface area is rapidly being reduced by peripheral weed growth. The lake is fed by three small tributaries, of which Corbin Creek is the largest.

Historically Robe Lake was a major sockeye salmon producer. At the present time the lake receives an average annual run of approximately 5,000 sockeye salmon and 2,500 coho salmon. Dolly Varden and threespine stickleback are also present in large numbers.

Previous studies of Robe Lake revealed that low dissolved oxygen concentrations during the winter may be limiting the amount of rearing area for juvenile coho salmon. These low D.O. concentrations are due to the shallowness of the lake, large amounts of decaying vegetation and low winter inflow of water. Various proposals have been made to enhance salmon populations of this system. These include (1) dredging the lake to increase the depth and reduce the growth of vegetation, (2) diverting part of Corbin Creek Robe so that it could enter the lake near the center of the east shore to increase the distance from the inlet to the outlet and increase the area of water circulation, (3) divert part of Corbin Creek Glacier into Corbin Creek Robe to increase the amount of water entering the lake, (4) an aquatic vegetation control program which could increase winter D.O. concentrations, and (5) a stickleback control program to reduce the competition for space, food and oxygen.

During the winter of 1977-78 studies were initiated to determine the feasibility of the enhancement proposals.

Investigations were conducted on the Robe Lake system which includes Corbin Creek Glacier, Corbin Creek Robe, Brownie Creek, Robe River, and Robe Lake, (Figure 7).

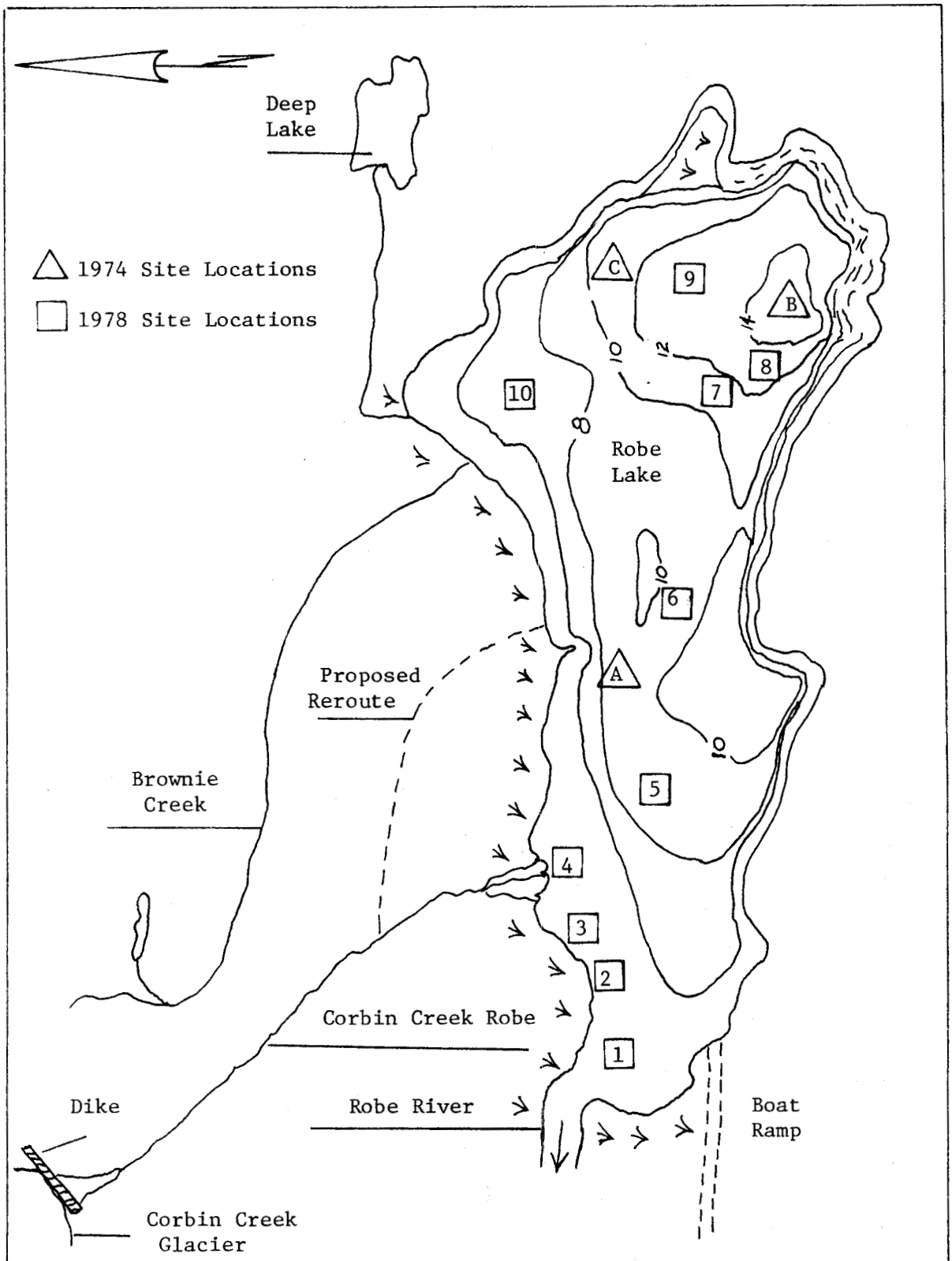

Figure 7 . Locations of 1974 and 1978 D.O. Sites & 1978 Fish Trapping Sites.

Minnow traps were used to catch juvenile coho salmon, Dolly Varden, and threespine stickleback. These traps were set at various locations in the lake and streams (Figure 7). The results of this trapping are presented in Tables 12 and 13. Juvenile coho salmon were caught in all but five of the traps set. Where traps were set at different levels, the upper traps usually caught more coho salmon. This was due to better dissolved oxygen conditions in the upper levels of the lake.

Juvenile coho salmon were aged using scale samples. Age 0+ fish ranged in fork length from 41 to 77 mm and averaged 60 mm. The Age 1+ coho salmon averaged 93 mm and ranged from 80 mm to 121 mm in fork length. In 1973, 35 adult coho salmon taken from Corbin Creek were Age 2.1. Adult coho salmon caught in Valdez Bay in 1978 were also Age 2.1.

Although up to 5,000 sockeye salmon spawn annually in Brownie Creek, no juveniles were taken by traps in the creek. However, juvenile sockeye were taken with traps in Robe River during June 1978. Adult sockeye salmon taken from Robe Lake were found to be Age 1.2.

Dissolved oxygen determinations were taken at four locations in Robe Lake. This information is presented and compared to 1974 findings in Table 14. The results of D.O. determinations made in 1978 did not agree in all cases with the results of 1974 determinations. For example, Station C had very low D.O. concentrations (1.0 ppm) throughout the winter of 1974. D.O. determinations made in 1978 at Station 9, adjacent to Station C, (Figure 7) showed 5 ppm. These differences were due to the differences in the ice thickness. During 1978 investigations the ice was very thin and there were many open holes. These conditions made additional dissolved oxygen studies on Robe Lake unsafe.

The areas of Corbin Creek Robe and Brownie Creek utilized for salmon spawning were visually checked. Flow measurements were not possible because 50% to 90% of the stream was covered with snow. The volume of water in Corbin Creek Robe appeared to be less than half the flow observed in October, 1977.

Corbin Creek Glacier was checked at the dike and was found to be completely dewatered. Observations made at this site in May, 1973, revealed the same situation.

From these findings it is apparent that there is no water to divert into Robe Lake from Corbin Creek Glacier during the winter.

The results of fish trapping showed that coho salmon were found distributed throughout the lake. With only one exception, more coho salmon were taken in the upper traps than in the deeper ones. This is due to the greater amounts of dissolved oxygen at the upper water levels.

It is apparent that in some years, such as 1978, when the ice was thin and open holes existed on the lake, D.O. levels were high enough to sustain coho salmon populations in most of Robe Lake. During other years ice conditions are such that only portions of the lake have D.O. concentrations high enough to accommodate rearing coho salmon.

Table 12. Results of Fish Trapping, Robe Lake, 1978. *

Set Number	Trap Depth (feet)	Number Coho Salmon	Number Dolly Varden	Number Stickleback	Hours
1	4	Trap lost under ice.			
2	5	37	12	14	26.0
3	4	10	5	12	25.25
4	4 1/2	2	0	200	24.5
5 U	4	22	2	46	23.5
L	7	5	1	163	
6 U	4	27	5	97	21.75
L	9	0	0	222	
7 U	4	31	5	1	21.5
L	9	1	0	150	
8 U	5	27	11	104	20.75
L	10	110	0	26	
9 U	8	33	5	32	20.25
L	13	1	0	235	
10 U	4	27	0	83	19.5
L	7	0	0	36	

* Minnow trap used, 16" long, 9" diameter, 27" circumference, 3/4" entrance hole.

Set Number with alphabetical designation of U is for upper trap and L is for lower trap.

Table 13. Results of Fish Trapping, Corbin Creek, Brownie Creek, Robe River and EStimated Velocities, 1978.

Location	Silver Salmon	Dolly Varden	Stickleback	Hours Trap Set	Flow
Corbin Creek					
100 yds. below Lehfeldt proposed reroute	34	8	0	17.75	Estimate less than 1 CFS
@ proposed reroute	15	0	0	17.5	Estimate less than 1 CFS
100 yds. above proposed reroute	5	1	0	17.25	Estimate less than 1 CFS
300 yds. above proposed reroute	4	0	0	17.0	Estimate less than 1 CFS
Slough Area 500 yds. upstream proposed reroute	24	3	0	18.0	Less than 1 CFS
1,000 yds. upstream proposed reroute	17	2	0	18.0	Less than 1 CFS
Brownie Creek					
Jct. of Lehfeldt trail & Brownie Creek	0	1	0	17.0	Estimate 3 CFS
300 yds. upstream jct. of Lehfeldt trail	3	3	5	17.0	Estimate 3 CFS
600 yds. upstream jct. of Lehfeldt trail	10	0	0	17.0	Estimate 3 CFS
Robe River					
100 yds. downstream Robe Lake	54	36	0	18.5	no flow estimate
300 yds. downstream from Robe Lake	79	36	4	18.0	No flow estimate
Pool above highway culvert	0	0	0	20.0	No flow estimate
75 yds. downstream highway culvert	0	0	1	20.0	No flow estimate

Table 14. Comparison of 1974 and 1978 Robe Lake Dissolved Oxygen.

Date	Station	Ice Depth (In.)	Depth of Sample of	Snow Depth	D.O./ PPM
January 8, 1974	A	27	6		8.5
	B	27	6		5.5
	C	27	6		1.0
January 27, 1974	A		6		7.0
	B		6		6.0
	C		6		1.0
February 27, 1974	A		6		10.0
	A		9		2.5
	B		6		5.0
	B		10		1.5
	C		6		1.0
March 22, 1974	A	36	6		8.0
	A	36	9		1.5
	B	36	6		4.5
	B	36	10		1.0
March 1, 1978	2	36	38	1	9.0
	3	1	5	0	2.0
	7	1	5	0	5.0
	9	1	5	0	5.0

* 1978 D.O. locations are same locations as fish trapping.

During a stream survey of Corbin Creek in October, 1977, it was found that 80% of the spawning coho salmon were below the proposed diversion site. This site appears to be the most logical place to put in a diversion, but the risk of losing the existing run of coho salmon is too great to consider this proposal.

From the results of this study it is apparent that the two stream diversion proposals are not feasible. The third proposal, which is to dredge and deepen the lake, was not considered in this study.

The proposal to control vegetation was also not considered. The use of herbicides is very strongly regulated by the State and the Federal Government, and such a program would only produce temporary or short term results.

A reduction in the Robe Lake system's stickleback population could reduce competition for space, food, and dissolved oxygen. However, it is considered impossible to eliminate all the stickleback in the system because of the large swampy areas. Previous attempts at stickleback control in Alaska have generally proven to be ineffective and costly, even in good situations.

Habitat Protection Investigation

Construction plans for a hydroelectric complex at Solomon Gulch Creek near Valdez, and an electric transmission line between Valdez and Glennallen, were reviewed periodically with the project designers and engineers to insure adequate protection to fish stocks.

Five Department of Transportation highway projects were reviewed and monitored.

A water control structure for Tolsona Lake was designed and the construction and installation was monitored. Tolsona Lake is important as a grayling sport fishery and is the source of grayling eggs for statewide distribution. The previous water control structure was not capable of maintaining lake water levels necessary to sustain fish life during winter months.

LITERATURE CITED

Watsjold, D.A. 1973. Population studies of game fish and evaluation of managed lakes in the Upper Cook Inlet drainage. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1972-1973, Project F-9-5, 14(G-111-D): 1-17.

_____. 1975. Inventory, cataloging and population sampling of the sport fish and sport fish waters in Upper Cook Inlet. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1974-1975, Project F-9-7, 16(G-I-D): 83.

Williams, Fred T. 1971. Inventory and cataloging of sport fish and sport fish waters of the Copper River and Prince William Sound drainages and the Upper Susitna River. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1970-1971, Project F-9-3, 12(G-I-F).

Prepared by:

Fred T. Williams
Fishery Biologist

Approved by:

Rupert E. Andrews, Director
Sport Fish Division

Mark C. Warner, Ph.D.
Sport Fish Research Chief